## III REMARKS

Summary Of Arguments For Patentablity

It is respectfully argued that the references cited by the examiner (Fox, Richardson, et al and Wobben) to not teach applicant's claimed invention.

Fox regulates voltage out of a generator by varying current in a wound field of the generator. Richardson controls induction generator torque by means of a field oriented control methods using an active rectifier to control three phase AC stator currents of the generator. In contradistinction, applicant controls generator torque by varying DC current in an inverter connected to a passive rectifier output of generator.

Wobben uses power output, rate of change of power output and power factor at individual wind turbines arranged in a wind farm for the purpose of controlling the total power output of the wind farm to thereby maintain compatibility with a utility to which the wind farm is attached. In contradistinction, applicant claims a dynamically adjustable power factor controller using a device separate from the wind turbines and located at a substation for adjusting the power factor of the aggregate output of a wind farm.

Arguments For Patentablity

For clarity, the paragraph numbers used below correspond to like numbered paragraphs in the Office Action.

Examiner's Claim Rejections under 35 USC 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for Examiner's rejections under item 2 below:

A person shall be entitled to a patent unless -

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 8-15, 21-23, and 28 were rejected by Examiner under 35 U.S.C. 102(b) above as being anticipated by U.S. Patent No, 5,017,857 to Fox.

Examiner asserts that Fox clearly teaches the construction of a circuit and method for voltage regulation of electric power sources.

Fox US Patent 5,017,857

Fox discloses a circuit and method for voltage regulation of an electric power source. Referring to figure 1 of the Fox patent, a voltage regulator, **36** is used to modify the excitation of the generator, **10** dependent upon inverter AC voltages **28**, **30**, and **32** and inverter AC currents **44**, **46**, and **48**, and DC voltage **56** and **58**. Line **63** through **65** in column **2** states that " All of these quantities are used by the voltage regulator to control the exciter field current of the generator, **10** by way of line **60**". All of the claims are written so as to describe how these signals are used by the voltage regulator to control the exciter field current of the generator.

Here are two possibilities to consider with respect to applicant's invention relative to the Fox patent. The first possibility is where applicant uses a permanent magnet generator. In this case there is no control whatsoever of an exciter field because the field does not exist in this type of generator. Since there is no exciter field, there is no voltage regulator, and hence it follows that no signals are measured which modify a voltage regulator.

The second case to consider is where applicant's invention uses a wound field generator instead of a permanent magnet generator. In this case, there is an exciter field. However,

in applicant's invention the exciter field exists independently of any connection to voltages or currents out of the inverter. Further, because the field current is independent, there are none of the measured signals identified in the Fox patent, and since these signals are not measured, they therefore cannot be used to modify the exciter field current as required in the Fox patent. Furthermore, the only way the wound field machine can replace the permanent magnet machine is for the exciter field current to be completely independent, which causes the two machines (wound field and premanent magnet machine) to operate identically.

The Fox patent deals entirely with voltage regulation issues. Applicant's invention relates to a power conversion system, which intentionally does not attempt to regulate voltage in any way. This is, in part, what is novel and unconventional about applicant's invention.

Distinguishing language of claims 1, 8-15 and 21-23:

> one or more sensors, an output thereof being sensor information ;
>
> ***
>
> a control unit connected to said one or more sensors and to said inverter, said control unit capable of varying DC current of said inverter in accordance with said sensor information.

Distinguishing language of claims 28-30:

> B. providing sensor information;
>
> ***
>
> F. varying said DC electrical power at said inverter in accordance with variations in said sensor information.

Examiner's Claim Rejections under 35 USC 103

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 103(a) which forms the basis for obviousness rejections set forth by Examiner:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior an are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 2-7, 16-1 8,24-25 and 29-31 were rejected by the Examiner under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,017,857 to Fox in view of U.S. Patent No. 5,083,039 A to Richardson et al.

Richardson, et al. US patent 5,083,039

Richardson discloses a variable speed wind turbine comprising a turbine rotor, which drives an AC induction generator, a power converter, consisting of an active rectifier and an inverter, which converts the generator output to fixed-frequency AC power, a generator controller, and an inverter controller. The generator controller uses field orientation to regulate either stator currents or voltages to control the torque reacted by the generator by means of the active rectifier. The inverter controller regulates the

output currents to supply multi-phase AC power having leading or lagging currents at an angle specified by a power factor control signal.

In Richardson the power converter controls stator electrical quantities for each phase of the turbine generator by means of the active rectifier. Turbine parameter sensors define a torque reference signal used to generate a torque command and to control the active rectifier so as to produce the commanded torque. The generator controller coupled to the power converter's active rectifier controls field orientation in response to the torque reference signal for defining a desired quadrature axis current in field coordinates, and controls active switches to produce stator electrical quantities that correspond to the desired quadrature axis current.

Consider again the two possibilities discussed in paragraph 2 above relative to the Richardson patent. The first possibility is where applicant uses a permanent magnet generator. In this case there is no control whatsoever of field orientation to regulate either stator currents or voltages because the field does not exist in this type of generator. Since there is no field, there is no converter control of field orientation as taught by Richardson. Consider that the applicant is using a synchronous generator consisting of a permanent magnet, or wound field type of generator. Furthermore the applicant does not propose an active rectifier using active switches, but rather a passive rectifier that does not have any active switches and which is incapable of performing field orientation on an induction generator.

The Examiner states that "It would have been obvious to one skilled in the art at the time the invention was made to use the circuit and method for voltage regulation of electric power sources disclosed by Fox on the variable speed wind turbine disclosed by Richardson et al. for the purpose of building a high capacity wind turbine while using

readily available generators".

The Examiner has failed to set forth a *prima facie* case of obviousness for rejections combining references under 35 USC 103 (obviousness).

The MPEP at 706.02 (j) sets forth a process by which a rejection under 35 USC 103 is to be sustained wherein, as in the present case, a single reference (Fox) is modified by combining it with one or more references (Richardson). The MPEP states that to establish a *prima facie* case of obviousness three basic criteria must be met:

(1) There must be some suggestion or motivation to modify the reference or to combine reference teachings.

(2) There must be some reasonable expectation of success.

(3) The references when combined must teach or suggest all the claim limitations.

These three criteria are analyzed below in order to show why the references cannot be properly combined:

(1) There must be some suggestion or motivation to modify the reference or to combine reference teachings.

The claims were rejected as being unpatentable over Fox in view of Richardson. Fox is the primary reference relied upon, and is the "reference" referred to in Step (1) above. Fox is therefore the reference to be modified.

The Examiner proposes that it would be obvious to modify the applied reference (Fox) to use the elements of Richardson to provide applicant's claimed turbine. The Examiner has failed to point out why the modification that he proposes would be obvious.

Applicant's invention is a combination and the crucial suggestion or motivation step in determining obviousness must be considered. The Examiner has failed to do this. Neither Fox nor Richardson contain anything to suggest the desirability of applicant's claimed combination or any motivation to modify Fox to vary the DC current in the inverter in response to sensed information as called for in applicant's claims. In order to satisfy this requirement, the Examiner must show that at least one of the references suggests that it is possible or desirable to modify the applied reference ( Fox) to vary the DC current in the inverter in response to sensor information.

(2) There must be some reasonable expectation of success.

There is no reasonable expectation of success in combining the references in the manner that the Examiner suggests because there is no provision in the inverter 26 of Fox for varying the DC current in the inverter in response to sensor information.

(3) the references when combined must teach or suggest all the claim limitations.

The references not only do not teach the claimed limitations, both Fox and Richardson teach away from applicant's invention. Fox teaches using a voltage regulator to modify the exciter field current of a generator. Richardson teaches controlling field orientation to regulate either stator currents or voltages to control the torque reacted by an induction generator.

6. In respect of claims 4 and 18, they are dependent from claims 1 and 16, respectively and are patentable for the reasons set forth under the paragraphs dealing with claims 1 and 16.

7. With regards to claim 5, Examiner asserts that it would have been an obvious matter of

design choice to use a set of power cables to conduct DC electrical power from the top of a tower to the bottom of a tower, since:

> the applicant has not disclosed that longer power cables solve any stated problem or is for any particular purpose and it appears that the invention would perform equally well with short power cables.

Claim 5 states:

> 5. The electric power-generating device of claim 1 wherein electric power-generating device is a wind turbine that includes said generator, and said passive rectifier, said wind turbine being located at the top of a tower and wherein said inverter is located at the bottom of said tower.

Applicant has disclosed that longer power cables are for the purpose of providing a lower total quantity of cables. Page 10, lines 1-10, of applicant's specification states:

> The preferred approach in the invention is to place the passive rectifier uptower and convert the synchronous generator AC voltage to DC. This results in a higher operating voltage on the pendant cables and lower total quantity of cables as each generator/rectifier now has two conductors associated with it rather than three conductors each. The DC pendant cables are only possible because of the coordinated high impedance of the synchronous generator, which limits the DC fault current in the event of a ground or pendant cable fault. The GCU which senses the DC bus voltage and current sense this fault condition and bring the turbine to zero speed very quickly. While this takes a finite amount of time, the current does not build up as it would with a low impedance case and the shutdown is very controlled and orderly.

8. Rejection of claims 19-31:

In respect of claims 29-30, Examiner combines Fox in view of Richardson et al. for the method step of bringing each of said generators online sequentially in low fluid-flow conditions to improve system efficiency at low power , such that each generator receives substantially similar utilization. Neither Fox nor of Richardson et al. disclose nor suggest bringing generators online sequentially.

It is believed that the Examiner intended to treat claim 31 under paragraph 9, below. Therefore, claim 31 is discussed under paragraph 9.

9. Claims 19-20, 26-27, and 32-34 were rejected by Examiner under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,017,857 to Fox in view of U.S. Patent No. 5,083,039 A to Richardson et al. as previously applied to claims 2-7 and 16-18 above, and further in view of U.S. Patent No. 6,724,097 B1 to Wobben.

It is believed that the Examiner intended to treat claim 31 under this paragraph. Therefore, claim 31 is discussed herein.

Wobben Patent US 6,724,097 B1

The Wobben patent discloses a wind park that includes a plurality of wind power installations. Each wind power installation has an output power and a maximum rated output power. The operating method comprises determining the total output power of all of the wind power installations. The output power of one or more of the wind power installations is then reduced if the total output power of all of the wind power installations exceeds the maximum permissible output power of the wind park.

The wind power installations may be arranged in a first row and a second row. In this case, the output of each wind power installation in the first row is maintained at

substantially its maximum rated output power. The output power of one or more wind power installation in the second row is controlled so that the output power of the entire wind park is substantially equal to the maximum permissible power output of the wind park.

The Wobben patent describes and claims a control system for a plurality of wind turbines and further provides for a method to reduce the power of one or more of the wind turbines within the wind farm. This would be useful for cases where there are very high winds and the wind farm could produce its full power, but the utility grid could only accept 50% to 75% of its rated power. In this case the Wobben control system reduces the output of one, or more than one of the turbines so that the 50% to 75% target power is met. Also, a data processing apparatus is used to determine the power of the aggregate.

In Figure 1 Wobben shows a power, power factor control and a dp/dt control function at the wind turbine. Brief mention is made of this in column 3, line 6 through 12. In applicant's application each turbine 710 (Figure 7) operates at unity power factor and power factor is not controlled at the turbines as Wobben has discussed.

Wobben discloses controlling power level, not power factor, or dp/dt and applicant controls power factor by means of a separate dynamic VAR control device 740 (Figure 7) that is separate from the uncontrolled unity power factor wind turbines and is located in the substation 730.

Fox in view of Richardson et al. fails to disclose a fluid flow farm.

Wobben is cited by Examiner to teach the construction of a method for operating a wind farm comprising a plurality of fluid-flow turbines each of which converts fluid-flow power into AC electrical power at substantially unity power factor. However, Wobben

does not teach fixed unity power factor but instead varies the power factor by the data processing apparatus of Figure 1 and uses the windturbine to cause the varying power factor at the windplant.

The Wobben data processing apparatus does not electrically connect each of the turbines to a substation wherein a dynamically adjustable power factor controller adjusts the power factor of the aggregate output of the wind farm. The Wobben data processing apparatus adjusts the power output of each turbine individually. This is shown in Figure 1 of Wobben wherein the input P is from a single wind turbine shown to the left of the drawing and is the power output of that one turbine. The implication of Wobben is that the microprocessor uP and inverter arrangement (rectifier, intermediate circuit and inverter) shown in Figure 1 and described at column 3, lines 14-19, is replicated for each of the three wind turbines shown in Figure 2. Each of the turbines 1, 2, 3, has a corresponding power output P1, P2 and P3 that enter the data processing apparatus (i.e. the microprocessors uP) as shown in Figure 2 to control the power output of each turbine. Therefore there is no dynamically adjustable power factor controller in Wobben that adjusts the power factor of the aggregate output of the wind farm.

Wobben at Column 3, lines 28-34 states:

> As each of the individual wind power installations has a power input for setting the power output of the respective installation (FIG. 1), the power output levels of an individual wind power installation can be set to a desired value by means of a data processing apparatus, by means of which the entire wind park is controlled.

Thus it is seen that Wobben controls the power output of each wind turbine installation.

Examiner asserts that it would have been obvious to one skilled in the art at the time the invention was made to use the circuit and method for voltage regulation of

variable speed wind turbines and electric power sources disclosed by Fox in view of Richardson et al. on the wind farm disclosed by Wobben for the purpose of providing a wind park equipped with a total power output which is higher than the maximum possible network feed-in power output.

The Examiner has failed to set forth a *prima facie* case of obviousness for rejections combining references under 35 USC 103 (obviousness). The MPEP at 706.02 (j) sets forth a process by which a rejection under 35 USC 103 is to be sustained wherein, as in the present case, a single reference (Fox) is modified by combining it with one or more references (Richardson):

The Examiner has failed to set forth a *prima facie* case of obviousness. The MPEP states that to establish a *prima facie* case of obviousness three basic criteria must be met:

(1) There must be some suggestion or motivation to modify the reference or to combine reference teachings.

(2) There must be some reasonable expectation of success.

(3) The references when combined must teach or suggest all the claim limitations.

These three criteria are analyzed below in order to show why the references cannot be properly combined:

(1) There must be some suggestion or motivation to modify the reference or to combine reference teachings.

The claims were rejected as being unpatentable over Fox in view of Richardson and further in view of Wobben. Fox is the primary reference relied upon, and is the "reference" referred to in Step 1. Fox is the reference to be modified.

The Examiner proposes that it would be obvious to modify the applied reference (Fox) to use the elements of Richardson and Wobben to provide the claimed wind farm. The Examiner has failed to point out why the proposed modification would be obvious.

Applicant's invention is a combination and the crucial suggestion or motivation step in determining obviousness must be considered. The Examiner has failed to do this. Neither Fox nor Richardson nor Wobben contain anything to suggest the desirability of applicant's claimed combination or any motivation to modify Fox to effectuate adjusting the power factor of the aggregate output of the turbines. In order to satisfy this requirement, the Examiner must show that at least one of the references suggests that it is possible or desirable to modify the applied reference to adjust the power factor of the aggregate output of the turbines.

(2) There must be some reasonable expectation of success.

There is no reasonable expectation of success in combining the references in the manner that the Examiner suggests because there is no provision in Fox for making the power factor adjustment at a substation.

(3) the references when combined must teach or suggest all the claim limitations.

The references do not teach controlling the power factor at a substation using a device separate form the wind turbines. Wobben teaches away from such a modification because Wobben controls the power level at each wind turbine installation and does not control power factor at a substation to vary the power output of the wind farm.

10. With regards to claims 32-34, Examiner combines Fox in view of Richardson et al. in

view of Wobben to supply the missing elements of applicant's claimed invention.

The references do not teach controlling the power factor at a substation as called for in applicant's claims 32-34. Wobben teaches away from such a modification because Wobben controls the power level at each wind turbine installation and does not control power factor at a substation to vary the power output of the wind farm.

Re-examination and allowance of claims 1-34, is respectfully requested.

Respectfully submitted,

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